

Technical Attachment

Design and Evaluation of an Advanced Linux-Based AWIPS Workstation

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Motivation

This project was motivated by a single goal: *To document what improvement, if any, is brought to the warning decision making process by a faster, more flexible D2D workstation, with an emphasis on ergonomics.* The WDTB Warning Decision Making Workshops suggest that the human factors aspect of the work environment, including usability of the equipment, is an important component of an optimized warning environment. Equipment that is slow to respond to commands, is difficult or slow to recover from faults, or is inflexible and causes fatigue can impede decision making.

The Vision

The project's vision was to completely replace a legacy HP dual-display graphic workstation *and* the HP Xterm text workstation with a *single PC and* improve the functional capability available to the forecaster.

The Workstation

The workstation (Figure1), dubbed AWIPS Advanced for evaluation survey purposes, is an IBM IntelliStation housing two 1.5 GHz P4 Xeon processors, 1 GB Rambus memory, a 36 GB SCSI hard drive, one Matrox G450 dual graphics card, one Nvidia GeForce single graphics card, one keyboard and one mouse. The workstation utilizes Red Hat Linux version 7.2 and the KDE desktop environment. The KDE environment was chosen because it was believed to be best suited to support a third display.

The workstation supports three 19" Sceptre LCD flat panel displays. LCD flat panels were selected due to their ability to provide crisp graphic displays, a small desk top foot print, their tendency to reduce eye fatigue, their low energy consumption, and minimal EMF. Given the increasing demands placed on display space by software (e.g. SCAN, FFMP, WWA) and the importance of base radar data evaluation, it was concluded that three displays were necessary, especially when text product preparation was considered.

Funding and technical support for the project was provided jointly by NWS Southern Region Headquarters and the Norman WFO. Total workstation cost, including LCD monitors, was approximately \$5600.



Figure 1 The prototype Linux-based PC featuring three LCD displays and improved workspace ergonomics.

The Evaluation

After localization with appropriate WFO Norman maps, WarnGen templates, procedures, and color tables, the prototype workstation was installed in the WFO operations area to serve as the primary workstation during convective warning operations. The HP workstation that previously served in that role was moved aside, but remained functional in the event the prototype system failed.

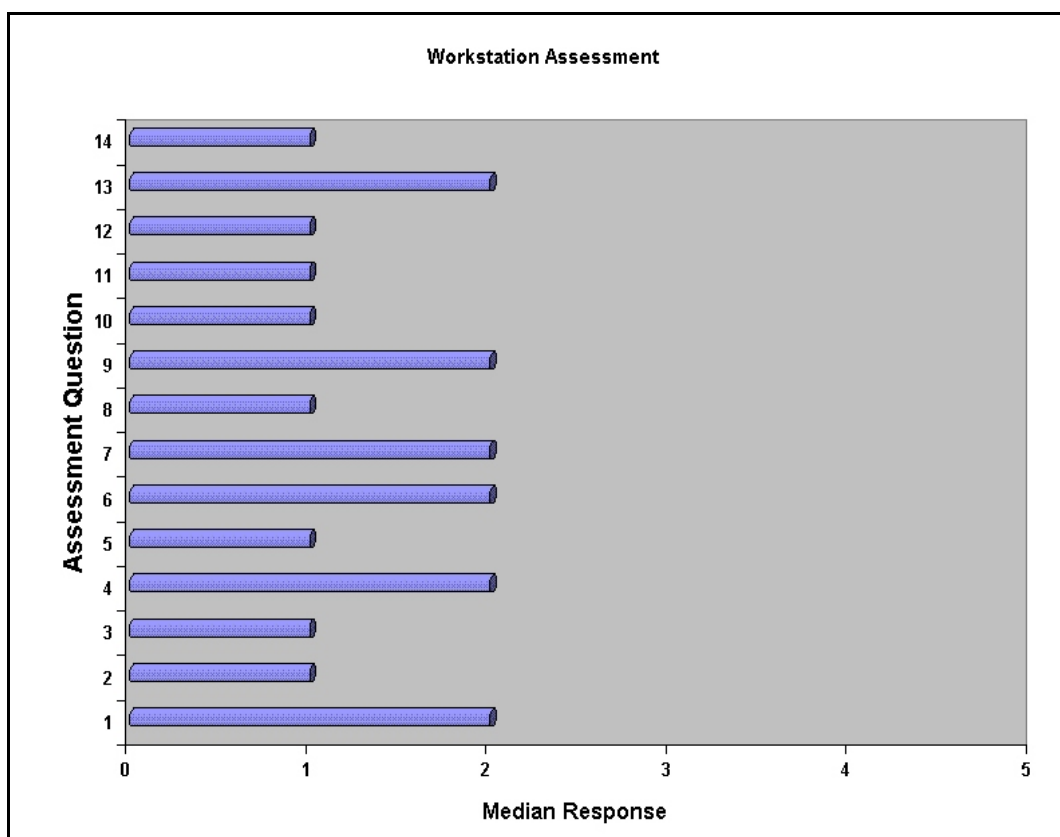
A survey (Attachment 1) was completed by each forecaster that used the workstation for warning operations. Survey questions asked the forecasters to compare the prototype AWIPS Advanced workstation to their experience with the legacy HP workstations during warning operations. Questions covered a variety of topics including the utility of a single mouse/keyboard, flexibility to configure D2D and workspaces, workstation speed and responsiveness, reliability, and ease of use. From May 1 through July 1, 2002 forecasters completed a total of 18 surveys.

The responses are summarized in Graph 1. The prototype workstation scored *better* or *much better* in all questions when compared to the older HP equipment. Of particular interest was question 14, which asked forecasters to compare the prototype to the HP equipment in overall suitability for warning operations. In this instance, the prototype's median score was 1, or *much better*.

The survey form also contained a section for comments. Among the comments, there was a general preference for having one keyboard and one mouse versus two on the current workstations. Forecasters, in general, preferred the ability to run three D2D sessions while running the text workstation software in a secondary workspace, usually on the left-most or middle monitor. The ability to rapidly restart the workstation and the increased workspace provided by the LCD displays was also viewed as a major plus. Forecasters also noted less

fatigue after several hours of warning operations. This likely stems from the increased workspace, LCD monitors which cause less eyestrain than CRTs, and the ability of the forecaster to remain stationary while assessing data and composing text as opposed to moving from side to side to accommodate bulky CRT monitors on the HP system.

Negative comments were in general related to unfamiliarity with the slightly different workspace manager (KDE). However, forecasters quickly acclimated the KDE environment. Comments also detailed some instances of pane crashes and auto-update failures, though they occurred less frequently than on the HP workstations. Finally, there were two instances of spontaneous reboots during the evaluation when text workstation software was running and text editing was occurring on the rightmost monitor (Nvidia card). The problem was not reproducible under controlled conditions and is likely related to a limitation associated with the Nvidia card.



Graph 1. Median responses to forecaster survey questions comparing the prototype AWIPS workstation to an HP workstation for warning operations.

Summary

The Linux-based PC workstation offers a very cost effective path to migrate warning operations away from the legacy AWIPS HP hardware. Of equal importance is the improved ergonomics and responsive characteristics of the prototype AWIPS Advanced workstation. These characteristics result in a much more flexible and user-friendly workstation. Finally, we believe the results of this demonstration can be used to help guide efforts to procure and deploy Linux-based systems in other NWS WFOs over the course of the next few years.

Attachment 1 - Advanced AWIPS Workstation Assessment

When considering the following questions, compare your latest experience using the IBM Advanced AWIPS workstation (AA) to similar experiences using the legacy HP workstations (HP). Please rank your response as follows:

1 = AA Much Improved/Better, 2 = AA Slightly Improved/Better, 3 = Equal, 4 = AA Slightly Degraded/Worse, 5 = AA Much Degraded/Worse

- 1) Ability to configure AA to support warning operations: 1 2 3 4 5
- 2) Utility of AA workstation's single mouse/keyboard (versus dual on HP) to compose warnings and statements: 1 2 3 4 5
- 3) Ability of AA to quickly and reliably swap panes: 1 2 3 4 5
- 4) Ability of AA to load imagery to support warning operations: 1 2 3 4 5
- 5) Ability/flexibility to configure D2D/Text WS among three AA monitors: 1 2 3 4 5
- 6) Ability to modify Warngen polygon on AA: 1 2 3 4 5
- 7) Ability to generate and transmit Warngen products on AA: 1 2 3 4 5
- 8) Responsiveness of AA to zoom and manipulate radar imagery: 1 2 3 4 5
- 9) Reliability of AA to auto update radar products: 1 2 3 4 5
- 10) AA overall suitability to support warning operations: 1 2 3 4 5
- 11) Foot print and ergonomic aspects of AA LCDs compared to HP CRTs: 1 2 3 4 5
- 12) Image color and clarity of AA LCDs compared to HP CRTs: 1 2 3 4 5
- 13) Text clarity / readability of AA LCDs compared to HP CRTs: 1 2 3 4 5
- 14) Overall suitability/preference for operational use of AA LCDs: 1 2 3 4 5
- 15) Maximum number of warning sectors/warning forecasters: _____
- 16) Number/coverage of severe storms: Isolated Scattered Numerous
- 17) Circle all phenomena observed or warned for: Tornadoes, Severe winds,
Hail golfball or smaller, Hail larger than golfballs, Supercells, Bow echo, Flash flood
- 18) Comments (if any, may use back):

Date/Time Period (UTC) workstation was used: _____

Initials (optional): _____